

Optical Analogue of Electronic Bloch Oscillations

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We report on the observation of Bloch oscillations in light transport through periodic dielectric systems (cover story of Phys. Rev. Lett. **91** [1]). By introducing a linear refractive index gradient along the propagation direction the optical equivalent of a Wannier-Stark ladder was obtained. Bloch oscillations were observed as time-resolved oscillations in transmission, in direct analogy to electronic Bloch oscillations in conducting crystals where the Wannier-Stark ladder is obtained via an external electric field. The observed oscillatory behaviour is in excellent agreement with transfer matrix calculations.

In addition when the linear gradient is strong enough, two minibands can overlap and Zener tunnelling can occur between them, in analogy with the Zener breakdown in semiconductors [2].

[1] R. Sapienza, P. Costantino, D. S. Wiersma, M. Ghulinyan, C. J. Oton, L. Pavesi, Optical Analogue of Electronic Bloch Oscillations, *Phys. Rev. Lett.* **91**, 263902 (2003).

[2] M. Ghulinyan, C. J. Oton, Z. Gaburro, and L. Pavesi, C. Toninelli and D. S. Wiersma, to be published, (2005).